

Supplementary Material

Supplementary Table 1. Number of complete twin pairs across zygosity and sex for all study measures.

	Anxiety	Conduct	Hyper	Peers	Prosoc	Education
<i>Age 4</i>						
MZM	1165	1166	1166	1163	1166	-
MZF	1350	1350	1348	1348	1350	-
DZM	1193	1196	1195	1193	1196	-
DZF	1247	1247	1245	1245	1247	-
DZOS	2344	2350	2345	2345	2352	-
<i>Age 12</i>						
MZM	912	911	912	912	913	-
MZF	1130	1130	1130	1130	1132	-
DZM	844	845	845	845	847	-
DZF	968	968	968	968	973	-
DZOS	1742	1742	1741	1741	1744	-
<i>Age 16</i>						
MZM	-	722	720	-	721	1012
MZF	-	1029	1028	-	1028	1253
DZM	-	670	670	-	670	948
DZF	-	889	886	-	888	1059
DZOS	-	1517	1513	-	1514	1991

Note. MZ = monozygotic; DZ = dizygotic; M = male; F = female; OS = opposite –sex; conduct = conduct problems; hyper = hyperactivity; peers = peer problems; prosoc = prosociality; education = educational achievement

Supplementary Table 2. Phenotypic correlations between SDQ variables and educational achievement

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Anxiety _{Age4}	-												
2. Conduct _{Age4}	.26	-											
3. Hyper _{Age4}	.18	.42	-										
4. Peers _{Age4}	.29	.23	.14	-									
5. Prosoc _{Age4}	-.05	-.31	-.24	-.22	-								
6. Anxiety _{Age12}	.31	.18	.12	.17	-.04	-							
7. Conduct _{Age12}	.17	.40	.25	.14	-.14	.31	-						
8. Hyper _{Age12}	.14	.31	.44	.16	-.15	.26	.47	-					
9. Peers _{Age12}	.16	.18	.15	.24	-.08	.36	.31	.28	-				
10. Prosoc _{Age12}	-.06	-.16	-.13	-.18	.33	-.07	-.31	-.26	-.18	-			
11. Conduct _{Age16}	.11	.29	.19	.10	-.09	.20	.49	.33	.19	-.20	-		
12. Hyper _{Age16}	.14	.25	.32	.15	-.10	.20	.38	.55	.20	-.189	.53	-	
13. Prosoc _{Age16}	-.04	-.17	-.12	-.16	.27	-.09	-.27	-.22	-.15	.45	-.40	-.33	-
14. Education	-.06	-.19	-.23	-.09	.02	-.10	-.24	-.35	-.14	.06	-.27	-.41	.11

Note. Correlations are taken from one individual in each twin pair; conduct = conduct problems; hyper = hyperactivity; peers = peer problems; prosoc = prosociality; education = educational achievement; all coefficient's > .03 are $p < .01$; $n_{\text{range}} = 3854\text{--}7382$.

Supplementary Table 3. Cross-sectional twin analysis results for SDQ variables

Variable	A	C	E
Anxiety _{Age4}	.58	.00	.42
Conduct problems _{Age4}	.64	.00	.36
Hyperactivity _{Age4}	.42	.00	.58
Peer problems _{Age4}	.67	.01	.31
Prosociality _{Age4}	.59	.00	.41
Anxiety _{Age12}	.53	.05	.41
Conduct problems _{Age12}	.59	.18	.23
Hyperactivity _{Age12}	.74	.00	.25
Peer problems _{Age12}	.72	.00	.27
Prosociality _{Age12}	.64	.12	.24
Conduct problems _{Age16}	.74	.00	.27
Hyperactivity _{Age16}	.74	.00	.26
Prosociality _{Age16}	.53	.32	.15

Note. A = additive genetic effects; C = shared-environment effects; E = nonshared-environment effects; bolded = $p < .05$.

Supplementary Table 4. Correlations between SDQ variables and educational achievement for MZ twin pairs

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Anxiety _{Age4}	.56													
2. Conduct _{Age4}	.26	.64												
3. Hyper _{Age4}	.21	.33	.52											
4. Peers _{Age4}	.19	.21	.22	.65										
5. Prosoc _{Age4}	-.05	-.15	-.17	-.20	.59									
6. Anxiety _{Age12}	.26	.16	.10	.10	-.02	.59								
7. Conduct _{Age12}	.15	.36	.23	.12	-.12	.30	.76							
8. Hyper _{Age12}	.15	.30	.33	.17	-.14	.26	.45	.75						
9. Peers _{Age12}	.11	.21	.16	.17	-.07	.29	.27	.28	.70					
10. Prosoc _{Age12}	-.05	-.14	-.15	-.14	.27	-.13	-.28	-.29	-.20	.77				
11. Conduct _{Age16}	.11	.25	.19	.12	-.09	.17	.37	.32	.14	-.17	.71			
12. Hyper _{Age16}	.12	.22	.24	.14	-.12	.17	.36	.46	.18	-.19	.42	.73		
13. Prosoc _{Age16}	-.04	-.16	-.18	-.17	.25	-.10	-.30	-.30	-.15	.43	-.35	-.35	.85	
14. Education	-.07	-.20	-.20	-.07	.03	-.10	-.24	-.32	-.15	.10	-.23	-.35	.10	.89

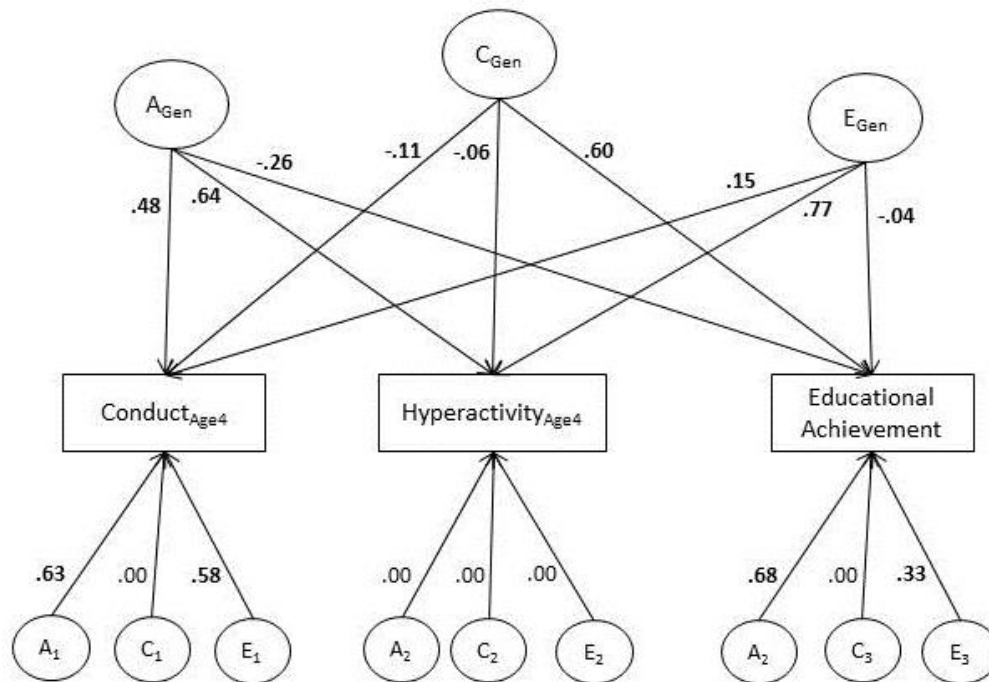
Note. conduct = conduct problems; hyper = hyperactivity; peers = peer problems; prosoc = prosociality; education = educational achievement; all coefficient's > .07 are $p < .01$; $n_{\text{range}} = 1419\text{-}2516$.

Supplementary Table 5. Correlations between SDQ variables and educational achievement for DZ twin pairs

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Anxiety _{Age4}	.31													
2. Conduct _{Age4}	.22	.34												
3. Hyper _{Age4}	.16	.16	-.05											
4. Peers _{Age4}	.16	.23	.17	.36										
5. Prosoc _{Age4}	-.04	-.06	-.07	-.12	.32									
6. Anxiety _{Age12}	.19	.15	.09	.13	-.05	.33								
7. Conduct _{Age12}	.16	.24	.12	.17	-.09	.22	.50							
8. Hyper _{Age12}	.13	.17	.05	.16	-.08	.22	.23	.23						
9. Peers _{Age12}	.16	.15	.07	.18	-.05	.20	.24	.18	.38					
10. Prosoc _{Age12}	-.06	-.12	-.12	-.12	.17	-.10	-.21	-.21	-.16	.46				
11. Conduct _{Age16}	.11	.14	.09	.10	-.03	.15	.20	.12	.13	-.11	.38			
12. Hyper _{Age16}	.09	.13	.06	.11	-.04	.14	.16	.10	.17	-.15	.23	.25		
13. Prosoc _{Age16}	-.05	-.09	-.07	-.11	.14	-.09	-.17	-.15	-.09	.22	-.20	-.23	.58	
14. Education	-.08	-.13	-.07	-.09	.01	-.08	-.18	-.13	-.13	.05	-.18	-.17	.10	.58

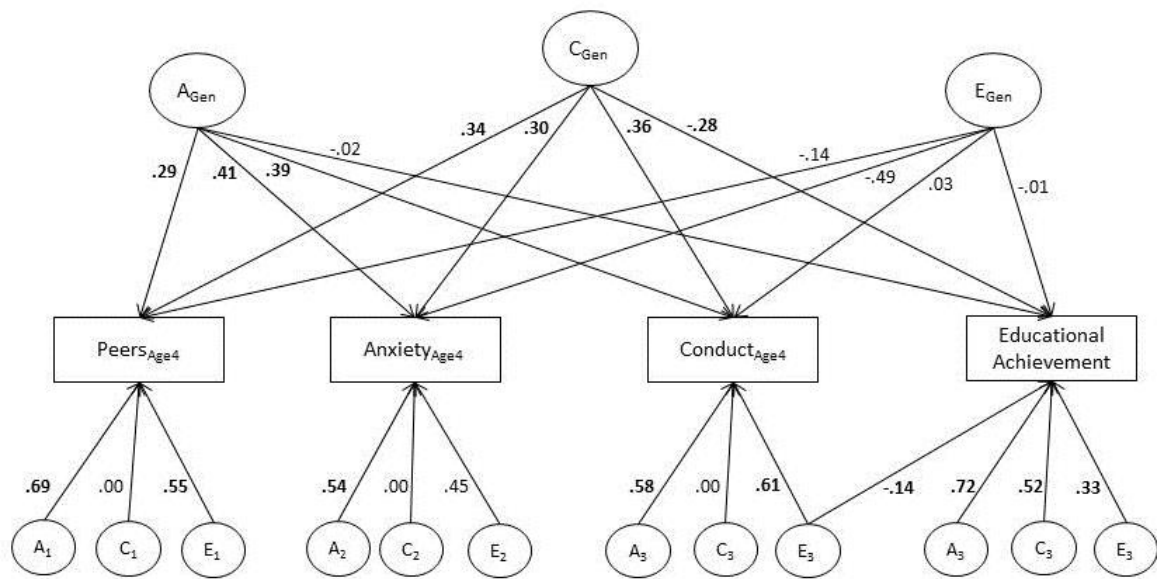
Note. conduct = conduct problems; hyper = hyperactivity; peers = peer problems; prosoc = prosociality; education = educational achievement; all coefficient's > .05 or < -.05 are $p < .01$; $n_{\text{range}} = 2433\text{-}4795$.

Supplementary Figure 1. Independent pathway model for conduct problems (age 4), hyperactivity (age 4), and educational achievement (age 16).



Note. A = additive genetic effects; C = shared-environment effects; E = nonshared-environment effects; gene = general factor; bolded = p < .05.

Supplementary Figure 2. Modified independent pathway model for peer problems (age 4), anxiety (age 4), conduct problems (age 4), and educational achievement (age 16).



Note. A = additive genetic effects; C = shared-environment effects; E = nonshared-environment effects; gene = general factor; bolded = $p < .05$.